

To determine maximum daily demands and peak hourly demands the following multipliers shall be used:

Maximum Daily Demand	=	1.8 times Average Daily Demand
Peak Hourly Demand	=	2.36 times Average Daily Demand

Fire flow requirements for non-residential areas shall be in accordance with the National Fire Protection Association Handbook (latest revisions) and the applicable sections of BOCA, and shall be coordinated with the Fire Administration Department. That portion of the Fire Sprinkler Systems to be maintained by the Department of Public Utilities shall be designed in accordance with the requirements as set forth in Appendix 8.

Minimum pipe size shall be 8", except that terminal water lines will be six (6) inches in diameter unless a larger diameter line is needed to meet the peak domestic demand and/or fire flow requirements. Dead-ends shall be eliminated by looping when feasible.

Services and meters shall be sized and locations designed in accordance with the Standard Details. Minimum service size shall be 3/4" pipe with 5/8" meter. Services shall be designed and reflected on the plans for both residential and commercial developments. A 1" County service line will be installed when the residential water service from the main to the meter is 60' or greater; or the peak hour pressure at the main is 40 psi or less. When the peak hour pressure at the probable house site is less than 40 psi and depending on such variables as: house location, number of fixtures, number of finished floors, etc., a note must be added to the plans: "The builder may consider installing a larger plumbing line from the meter to the house and/or installing a booster pump to obtain a desired pressure".

Pressure reducing valves shall be installed on the customer side of the meter by builder or property owner, to be operated and maintained by the customer, when the service connection system pressure will be greater than 80 psi.

Blowoffs shall be provided at low points on mains 16-inches and larger. For 12-inch mains, blowoffs shall be provided at creek crossings.

Engineer should use the following guidelines, in regard to location of flush points, air release valves, blowoffs, etc. during the design of public water systems:

1. Access to flush points by contractors and especially to the County Operations and Maintenance Section is very important. Flush points serve no purpose if access to the flush points can not be obtained.
2. Engineer needs to make sure that appropriate notes i.e., flow (gpm) expected to be dispersed at points of flushing; etc. are put on the plans.

Sanitary sewage force mains shall be ductile iron (Class 52) or approved equal. A higher class if the design parameters require a thicker pipe. For 12" and smaller, PVC C-900 or other approved water type pipe may be used. Force mains to be designed with a minimum flow velocity of 3.0 feet per second, a maximum flow velocity of 8.0 feet per second; and a Hazen-Williams "C" value of 120. Minimum size shall be 4 inches in diameter. A constant grade shall be used where feasible. Minimum ground cover shall be same as required for water lines or deeper where necessary to accommodate water services and/or future water lines, etc. Valves and air releases will be provided at appropriate locations.

Manholes receiving the discharge from force mains shall be designed in accordance with the County's standard details. In addition, special acid-resistant manholes and sewer pipe shall be provided downstream of the discharge point as determined by the engineer (hydrogen sulfide calculations are required). On existing systems, manholes shall receive an approved liner. Liner shall be as shown in the standard details.

### **WATER PUMP STATIONS**

Water pump stations shall be considered a special project and specific project standards and plans will be prepared by the Engineer and submitted to the County for review and approval. The project standards shall include but not limited to contents as set forth in Appendix 9.

### **WATER LINE LOCATION**

Generally, water lines to be installed in proposed subdivision and local streets shall be located 2 feet off the edge of pavement where there is no curb and gutter and 4 feet in front of the face of curb (pavement side) where there is. However, within proposed curb and gutter streets, an alternate design should be considered if right-of-way is available and a design is feasible. Water lines to be installed along existing roads will generally be installed in easements where the road is likely to be widened in the future and in the right of way where the road will not be widened in the future.

Where water lines are to be installed in roads expected to be widened in the future, they shall be located in easements unless the future road cross section is known and location of water line is designed to avoid future relocation.

Water lines shall be designed so that changes in alignment are made with bends with approved thrust blocks or approved mechanical joint restraint systems wherever applicable. All mechanical joint thrust restraint system calculations to be shown on plans with a detail sketch showing length of pipe and fittings to be restrained. See Part V for additional specifications and requirements. Where it is necessary to change alignment by deflecting successive lengths of pipe, the joint deflection shall be limited to the allowable deflection according to standard details) in Part II of this manual, which represents one-half the maximum allowable by most manufacturers. For PVC pipe, the deflection is made by curving the pipe, since there is no deflection capability in the joints. The bending radius shall be limited as per standard detail (s) in Part II of this manual.

Bending and joint deflection limits apply to vertical as well as horizontal curves. Engineer is to verify existing field conditions to develop soil classifications for calculated bearing pressures.

The engineer must design the system to ensure that the maximum deflection can be accomplished, however, fittings may be necessary and the engineer shall make this determination during design.

In subdivisions, water mains will be permitted in easements only when there is no other feasible alternative and prior approval is obtained from the Department of Public Utilities. Easements shall be wide enough to provide sufficient space for both installation and maintenance.

The engineer shall consider the location of existing and proposed sanitary sewer and storm drainage systems and all other underground structures and utilities that could affect the location and type of materials for the pipeline. The selected location should avoid conflicts and facilitate future maintenance.

Where the possibility of conflicts with existing utilities and/or other structures exist, it shall be the Engineer's responsibility to secure accurate information on the exact horizontal and vertical location of such utilities through subsurface exploration and reflect this exact information on the plans.

The engineer shall consider the requirement for separation of water and sanitary sewer facilities and shall use the same requirements stated in the SANITARY SEWER LOCATION section of these standards.

Water main crossings of railroads and where required, roadways shall be encased in a casing pipe. Design of railroad crossings shall comply with the requirements of American Railway Engineering Association Specifications, Part 5 - Pipelines (latest revisions). The engineer shall be responsible for the preparation of the necessary application, at least 180 days in advance of construction or advertisement for bid, for submission by the County to the railroad or in a timely fashion as determined by the Department and/or Engineer.

Water mains entering or crossing streams, shall be Ductile Iron Pipe (minimum Class 52). The tops of these mains shall be a sufficient depth below the natural bottom of the streambed to protect the pipe. In general, 3.5 feet of suitable cover is required. The pipe and joints shall be designed, constructed, and protected against anticipated hydraulic and physical, longitudinal, vertical, horizontal loads, erosion and impact. Reasons for requesting less cover shall be given in writing to the County prior to plan submittal. Water mains constructed in fill shall be Ductile Iron Pipe (Class 52) with restrained joints unless a licensed geotechnical engineer can furnish a certification that the fill has been compacted so that settlement of the main will not occur. Such certification shall apply to the area directly above as well as below the pipe.

## **II - PRODUCTS**

### **2.01 APPROVED MATERIALS**

All materials shall conform to the County of Chesterfield "Approved Materials and Manufacturers" list with latest revision date. Contractor shall follow guidelines as established in the General Conditions of this document under Other Plans and Working Drawings (Shop Drawings). All materials shall be virgin material.

### **2.02 PIPE BEDDING FOR GRAVITY SANITARY SEWERS**

Bedding material to be crushed stone #57 gradation in accordance with VDOT Road and Bridge Specifications, latest edition.

## **III - EXECUTION**

### **3.01 INSTALLATION OF NEW GRAVITY SANITARY SEWER AND FORCE MAIN SYSTEMS**

#### **A. Excavating and Backfilling:**

1. Contractor shall do all excavating of any and all materials encountered in the course of excavating for all underground utility systems. After the pipe is in place, backfill with suitable material free from frozen earth, rocks, organic material, etc.
  - a. Provide all necessary shoring required for the protection of excavations, existing utilities and workmen and do all necessary pumping required to keep excavation and pipe free from water from any source at all times.
  - b. Provide sufficient barricades, etc., adjacent to excavations to safeguard against injury to workmen and the public. Provide and maintain sufficient warning lanterns at walks, roadways, and parking areas to provide safety at all times.
  - c. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.
  - d. Exercise special care in backfilling trenches to guard against disturbing the joints.
  - e. Remove and dispose of any material not used for backfill.

2. Removal of subsurface obstructions, which are uncovered during excavation for installation of the gravity sanitary sewer and force main systems shall be by the Contractor at his expense. This shall include removal of existing concrete or brick of existing building foundations, footings, abandoned utility piping, wires, structures, rock boulders, etc., which may not be visible from surface investigations before construction, but will interfere with new installations. If such obstructions are encountered, they shall be removed two feet from around the area of new work and the excavation backfilled with a suitable material as specified.

B. Pipe Handling:

1. Take all precautions to insure that pipe and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.
2. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Flushing line may be necessary by the Contractor.
3. Survey Line and Grade for Gravity Sanitary Sewers:
  - a. Line and grade shall be maintained by the Contractor by use of a laser and Contractor shall adhere to the following criteria:
    - 1) Control point shall be set at a minimum of fifty foot (50') interval. Line and grade of the laser shall be checked at a maximum of one hundred foot (100') intervals.
    - 2) Standard cut sheet shall be provided to the County showing center line cut each twenty-five (25') where payment for installation is on a cut increment basis and hub cut at each fifty foot (50') station.
    - 3) The level vial on the grade instrument of the laser shall be checked at a minimum of each 30 minutes of use or more frequent if equipment is being used around the grade instrument that could cause the instrument to become unlevel.
    - 4) A blower shall be used when required to keep a uniform air temperature in the pipe to prevent any bending of the light beam.

- b. Contractor shall have level or transit in good working order on job set up at all times to periodically check line and grade of pipe.
4. Sewer Pipe Laying for Gravity Sanitary Sewers:
- a. Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces.
  - b. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the drawings. After completion the pipe shall exhibit a full circle of light at one manhole when viewed from the next.
  - c. The sewer pipe, unless otherwise approved by the Owner, shall be laid up to grade from point of connection of the existing sewer or from a designated starting point. If the starting point is an existing stub, it shall be removed and a full length of pipe installed. The sewer pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with a water tight plug or cap.
  - d. The pipe shall be fitted and matched so that when installed it will form a smooth, uniform invert. Lined or radius concrete pipe shall be placed as indicated by the marking on the pipe.
  - e. Prior to joining the pipe, all surfaces of the pipe to be joined and the surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, etc., shall be applied and the pipes joined as recommended by the manufacturer's specifications. Sufficient pressure shall be applied in making the joint to assure that the pipe is "home". The interior of the pipe shall be cleaned of all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.

f. Joining Pipe for Gravity Sanitary Sewers:

- 1) Ductile iron pipe to be joined in accordance with the requirements of the AWWA Standard C600 and the manufacturer's recommendations.
  - 2) Reinforced concrete pipe shall be jointed in accordance with manufacturer's recommendations.
  - 3) Polyvinyl chloride (PVC) pipe shall be joined in accordance with ASTM Standard D-2321.
- g. Pipe laying and joining for force mains shall be the same as the requirements for water lines.
- h. All visible leaks shall be corrected before testing.
- i. PVC pipe shall be provided with anti-flotation ballast where cover is less than 3'.

C. Manhole Installation:

1. Manholes shall be constructed to the elevations indicated in accordance with the Standard Details.
  - a. Set manhole base section on bed of #57 stone to a minimum depth of 8 in. Stone shall be thoroughly compacted and carefully leveled to the excavated wall.
  - b. Join all manhole risers, cone top sections, and any other sections by the use of rubber gaskets.
  - c. Install pipe stubs in manholes where called for on the Plans. All stubs shall extend beyond the manhole as reflected on the plans and shall be sealed with a watertight plug or cap.
  - d. Install flexible manhole connections for all pipes sizes 6 in. to 21 in., inclusive and apply sealant to completely fill joint between manhole barrel and flexible connection for the full thickness of the manhole barrel.
  - e. Plug lift holes from the outside with nonshrink grout and repair any defects in manhole.
  - f.. Set adjusting rings in portland cement mortar bed (minimum of 1/4" thickness and parge 1/8" to 1/4" thickness on inside and outside of manhole).

- g. Rings will not be required outside of paved roadways or walkways unless called for on the Plans.
- h. Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame. Maximum height of rings shall not exceed 12, otherwise, the cone section will require removal and an additional manhole riser installed to allow for the upward and downward adjustment as stated above.
- i. Construct bench of concrete or brick and mortar only.
  - 1) Elevation of bench at the channel shall be at the spring line of the incoming and outgoing pipe.
  - 2) Bench shall be three inches lower at channel than at manhole wall.
  - 3) Where B.U.O. or stubs are provided for future pipe connections, bench and invert shall be so formed.
  - 4) Use sulfate resistant cement for concrete or mortar on all acid-resistant manholes.
  - 5) Where sealant is used, bench shall not be in contact with pipe or flexible pipe connection.
  - 6) All inverts to be smooth.
- j. All visible leaks shall be corrected before testing.

D. Service Connections: Place a tee fitting with 6-inch outlet in the sewer where service connection is to be constructed. Lay 6 inch PVC or ductile iron pipe from the tee to the property line or easement limits on a grade of not less than 1/4 in. per foot unless otherwise shown on Plans. Where connections are laid out of manholes, Contractor shall use a laser beam. Close service connection at the property line with an approved watertight plug, and mark the end with a 2" x 4" board installed plumb from bottom of 6" plug to 2' above ground. Service connection shall be of same type of pipe as sewer unless otherwise approved by Owner. When making a service connection to an existing sewer, the Contractor shall use a mechanical hole cutter and approved saddle.

E. Existing Manhole Tie-In: Core drilling and a flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to precast manholes, where stubs or bricked up openings (B.U.O.) do not exist.

The connector shall be Kor-N-Seal assembly or approved equal.

The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer.

The connector shall be of a size specifically designed for the pipe material and size being utilized on the project. All materials must conform to the approved products reflected in Part V of this document.

Where bricked up openings (B.U.O.) exist, a PVC manhole adaptor shall be used in the connection of the sewer pipe to precast manholes and installed using the proper conventional methods such as the process established for the "GPK PVC Manhole Adaptors" or equal.

- F. A tracing wire of 14 gauge copper shall be installed and taped directly on top of the pipe in a manner that a continuous trace results.
- G. Place underground warning tape directly above all sewer force mains, 18" below finished grade. Tape shall be polyethylene tape with a metallic core, 2 inches in width, with the continuous printed message "Caution Sewer Force Main Buried Below." Tape shall be as manufactured by the Seton Name Plate Corp. or approved equal.

### **3.02 TESTING OF NEW GRAVITY SANITARY SEWER AND FORCE MAIN SYSTEMS**

- A. Testing Technique for Gravity Sanitary Sewer System:
  - 1. Sanitary sewer lines 42 inches in diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C828-90 or latest edition. Sewer lines larger than 42 inches in diameter shall be tested by infiltration/exfiltration test. All manholes shall be vacuum tested. All testing shall be conducted in the presence of the Owner or Owner's representative. All labor, materials, tools, and equipment necessary to make the tests shall be provided by the Contractor. All equipment and methods used shall be acceptable to the Owner. All monitoring gauges shall be subject to calibration, if deemed necessary.
  - 2. Low Pressure Air Test:
    - a. Summary of Method: Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.
    - b. Preparation of the Sewer Line: If required by Owner, flush and clean the sewer line prior to testing and cleaning out any debris. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested. Give special attention to laterals.

- c. Ground Water Determination: Install a ½ inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.
- d. Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828-90 or latest edition. The pressure-holding time is based on an average holding pressure of 3 psi gage or a drop from 3.5 psi to 2.5 psi gage.

Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gage. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gage, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psi gage. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi gage during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psi gage drop has not occurred.

The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.

If the pipe to be tested is submerged in ground water, the test pressure shall be increased by 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer.

- e. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 lb. is exerted on an 8 inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

As a safety precaution, pressurized equipment shall include a regulator or relief valve set at no more than 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

3. All manholes will be tested using the negative air pressure test (vacuum) in accordance with ASTM C 1244-93 or latest edition, for watertightness, and manhole will be visually inspected after backfilling. Contractor may backfill before testing with the understanding that any repairs will be made from the exterior of the manhole.

Manholes shall be vacuum tested and shall have 10-inches of mercury applied to the manhole and the time measured for the vacuum to drop from 10-inches to 9-inches of mercury. Vacuum equipment shall be approved by the County and/or Engineer prior to its use. See detail # SEW-10 for minimum allowable test times for manhole acceptance at the specified vacuum drop.

Test times for structures other than manholes will be based on the times for manholes of the nearest equivalent volume or as directed by the Engineer.

Written verification must be furnished that the following steps are followed:

- a. The test method is only to be applied to precast concrete manholes.
  - b. Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.
  - c. If a manhole fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test.
4. Test for leakage of gravity sewers using either the infiltration or exfiltration test:

- a. Allowable leakage shall be 50 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2,400 gallons per mile per 24 hours for gravity sewers greater than 42" in diameter.
- b. Use infiltration test when ground water is at least 4 feet above pipe crown along entire length of line to be tested. Plug the pipe at the upper manhole. Install suitable measuring device at the next lowest manhole. Measure the amount of water flowing through the outlet after flow has been stabilized.
- c. Ground Water Determination: Use same procedure as "low pressure air test" above.

B. Testing Requirements for Sewer Force Mains:

1. All pressure testing shall conform to the requirements as established for Water Distribution Systems as outlined in Part III Section 3 of this document.

### **3.03 MARKERS**

In easements and in undeveloped wooded areas, plastic markers shall be installed every 200 feet, and at all manholes, valves, and fittings. Markers shall be as manufactured by Carsonite, Greenline, or approved equal. Exceptions are where sanitary gravity and force main lines are installed in "kept" yards where the property owners may object to the placement of these markers. Contractors will be required to properly install the markers per manufacturer's recommendations, parallel to the sewer line facing roadway, or as additionally directed by the County.

### **3.04 CLEAN-UP**

Upon the completion of the installation of the sanitary sewer system and prior to the Owner's final acceptance, sediment and debris shall be removed from the system. The work area shall be restored to its original condition and pavement replaced to the satisfaction of VDOT and/or County.

End of Section

## SECTION 2

### SANITARY SEWER SYSTEM

#### I - GENERAL

##### 1.01 REQUIREMENTS OF REGULATORY AGENCIES

Construction as shown on the plans or stated herein shall be performed in accordance with current and applicable requirements as established by the County of Chesterfield and the Virginia Department of Health or any other agencies having jurisdiction. Where conflicts arise between the Contract Documents and previously mentioned requirements, the more restrictive shall apply. If such requirements require a change in the work as stated herein or shown on the plans, the Contractor shall stop work and notify the County for further direction.

#### II - PRODUCTS

##### 2.01 APPROVED MATERIALS

All materials shall conform to the County of Chesterfield "Approved Materials and Manufacturers" list. All materials shall be virgin material. The Contractor shall submit a notarized statement from the Supplier and/or Manufacturer to the Inspection Section that all materials being supplied for the work meet AWWA, ASTM and/or County standards, as appropriate. At least three (3) copies for the County's use along with any additional copies needed to be returned to Contractor, Engineer, Suppliers, etc. after approval is made.

In addition, shop drawings, as defined in the General Section, and operation manuals are required [on projects where there are special structures, and on Pump Station, Tank, Pressure Reducing Vault, and Treatment Plant projects to include pipe and accessories, manholes and appurtenances, valves, and other assorted products, etc.] to be submitted by the Utilities Contractor to the Engineering Supervisor in charge of the Inspection Group for approval. The information needs to be sent as far in advance as possible (at least 48 hours) to avoid any unnecessary delays in beginning the project. The appropriate number of copies of shop drawings needed is as defined in the above paragraph.

The certification and/or shop drawings must include manufacturer's name, type of product, location of plant, project name and number, etc. for each product.

##### 2.02 PIPE BEDDING FOR GRAVITY SANITARY SEWERS

Bedding material to be crushed stone #57 gradation in accordance with VDOT Road and Bridge Specifications, latest edition.

### III - EXECUTION

#### 3.01 INSTALLATION OF NEW GRAVITY SANITARY SEWER AND FORCE MAIN SYSTEMS

##### A. Excavating and Backfilling:

1. Contractor shall do all excavating of any and all materials encountered in the course of excavating for all underground utility systems. After the pipe is in place, backfill with suitable material, free from frozen earth, rocks, organic materials, etc.
  - a. Provide all necessary shoring required for the protection of excavations, existing utilities and workmen and do all necessary pumping required to keep excavation and pipe free from water from any source at all times.
  - b. Provide sufficient barricades, etc., adjacent to excavations to safeguard against injury to workmen and the public. Provide and maintain sufficient warning lanterns at walks, roadways, and parking areas to provide safety at all times.
  - c. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.
  - d. Exercise special care in backfilling trenches to guard against disturbing the joints.
  - e. Remove and dispose of any material not used for backfill.
2. Removal of subsurface obstructions which are uncovered during excavation for installation of the gravity sanitary sewer and force main systems shall be by the Contractor at his expense. This shall include removal of existing concrete or brick of existing building foundations, footings, abandoned utility piping, wires, structures, rock boulders, etc., which may not be visible from surface investigations before construction, but will interfere with new installations. If such obstructions are encountered, they shall be removed two feet from around the area of new work and the excavation backfilled with a suitable material as specified.

##### B. Pipe Handling:

1. Take all precautions to insure that pipe and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

2. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Flushing line may be necessary by the Contractor.
3. Survey Line and Grade for gravity sanitary sewers:
  - a. Line and grade shall be maintained by the Contractor by the use of a laser and Contractor shall adhere to the following criteria:
    - 1) Control point shall be set at a minimum of fifty foot (50') interval. Line and grade of the laser shall be checked at a maximum of one hundred foot (100') intervals.
    - 2) Standard cut sheet shall be provided to the County showing center line cut each twenty-five feet (25') where payment for installation is on a cut increment basis and hub cut at each fifty foot (50') station.
    - 3) The level vial on the grade instrument of the laser shall be checked at a minimum of each 30 minutes of use or more frequent if equipment is being used around the grade instrument that could cause the instrument to become unlevel.
    - 4) A blower shall be used when required to keep a uniform air temperature in the pipe to prevent any bending of the light beam.
  - b. Contractor shall have level or transit in good working order on the job set up at all times to periodically check line and grade of pipe.
4. Sewer Pipe Laying for Gravity Sanitary Sewers:
  - a. Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces.
  - b. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the drawings. After completion the pipe shall exhibit a full circle of light at one manhole when viewed from the next.

- c. The sewer pipe, unless otherwise approved by the County, shall be laid upgrade from point of connection of the existing sewer or from a designated starting point. If the starting point is at an existing stub, it shall be removed and a full length of pipe installed. The sewer pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with a water tight plug or cap.
- d. The pipe shall be fitted and matched so that when installed it will form a smooth, uniform invert. Lined or radius concrete pipe shall be placed as indicated by the marking on the pipe.
- e. Prior to joining the pipe, all surfaces of the pipe to be joined and the surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, etc., shall be applied and the pipes joined as recommended by the manufacturer's specifications. Sufficient pressure shall be applied in making the joint to assure that the pipe is "home". The interior of the pipe shall be cleaned of all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.
- f. Joining Pipe for Gravity Sanitary Sewers:
  - 1) Ductile iron pipe to be joined in accordance with the requirements of AWWA Standard C600 and the manufacturer's recommendations.
  - 2) Asbestos-cement pipe shall be jointed in accordance with manufacturer's recommendations.
  - 3) Polyvinyl chloride (PVC) pipe shall be joined in accordance with ASTM Standard D-2321.
- g. Pipe laying and joining for force mains shall be the same as the requirements for water lines.
- h. All visible leaks shall be corrected prior to testing.
- i. PVC pipe shall be provided with anti-flotation ballast where cover is less than 3'.

C. Manhole Installation:

1. Manholes shall be constructed to the elevations indicated in accordance with the Standard Details.
  - a. Set manhole base section on bed of #57 stone to a minimum depth of 8 in. Stone shall be thoroughly compacted and carefully leveled to the excavated wall.
  - b. Join all manhole risers, cone top sections, and any other sections by the use of rubber gaskets.
  - c. Install pipe stubs in manholes where called for on the plans. All stubs shall extend beyond the manhole as reflected on the plans and shall be sealed with a watertight plug or cap.
  - d. Install flexible manhole connections for all pipes sizes 6 in. to 21 in., inclusive and apply sealant to completely fill joint between manhole barrel and flexible connection for the full thickness of the manhole barrel.
  - e. Plug lift holes from the outside with nonshrink grout and repair any defects in manhole.
  - f. Set adjusting rings in Portland cement mortar bed (minimum of 1/4" thickness and parge 1/8" to 1/4" thickness on inside and outside of manhole).
  - g. Rings will not be required outside of paved roadways or walkways unless called for on the plans.
  - h. Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame. Maximum height of rings shall not exceed 12", otherwise, the cone section will require removal and a new manhole riser installed to allow for the upward and downward adjustment as stated above.
  - i. Construct bench of concrete or brick and mortar.
    - 1) Elevation of bench at the channel shall be at the spring line of the incoming and outgoing pipe.
    - 2) Bench shall be three inches lower at channel than at manhole wall.
    - 3) Where B.U.O. or stubs are provided for future pipe connections, bench and invert shall be so formed.
    - 4) Use sulfate resistant cement for concrete or mortar on all acid-resistant manholes.

5) Where sealant is used, bench shall not be in contact with pipe or flexible pipe connection.

6) All inverts to be smooth.

j. All leaks shall be corrected prior to testing.

D. Service Connections: Place a tee fitting with 6-inch outlet in the sewer where service connection is to be constructed. Lay 6 inch PVC or ductile iron pipe from the tee to the property line or easement limits on a grade of not less than 1/4 in. per foot unless otherwise shown on plans. Where connections are laid out of manholes, contractor shall use a laser beam. Close service connection at the property line with an approved watertight plug, and mark the end with 2" x 4" board installed plumb from bottom of 6" plug to 2' above ground. Service connection shall be of same type of pipe as sewer unless otherwise approved by County. When making a service connection to an existing sewer, the Contractor shall use a mechanical hole cutter and approved saddle.

E. Existing Manhole Tie-In: Core drilling and a flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to precast manholes, where stubs or bricked up opening (B.U.O.) do not exist.

The connector shall be Kor-N-Seal assembly or approved equal.

The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer.

The connector shall be of a size specifically designed for the pipe material and size being utilized on the project. All materials must conform to the approved products reflected in Part V of this document.

Where bricked up openings (B.U.O.) exist, a PVC manhole adaptor shall be used in the connection of the sewer pipe to precast manholes and installed using the proper conventional methods such as the process established for the "GPK PVC Manhole Adaptors" or equal.

F. A tracing wire of 14 gauge copper shall be installed and taped directly on top of the pipe in a manner that a continuous trace results.

G. Place underground warning tape directly above all sewer force mains, 18" below finished grade. Tape shall be polyethylene tape with a metallic core, 2 inches in width, with the continuous printed message "Caution Sewer Force Main Buried Below." Tape shall be as manufactured by the Seton Name Plate Corp. or approved equal.

### 3.02 TESTING OF NEW GRAVITY SANITARY SEWER AND FORCE MAIN SYSTEMS

#### A. Testing Technique for Gravity Sanitary Sewer System:

1. Sanitary sewer lines 42 inches in diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C828-90 or latest edition. Sewer lines larger than 42 inches in diameter shall be tested by infiltration/exfiltration test.

All manholes shall be vacuum tested. All testing shall be conducted in the presence of the Owner or Owner's representative. All labor, materials, tools, and equipment necessary to make the tests shall be provided by the Contractor. All equipment and methods used shall be acceptable to the Owner. All monitoring gauges shall be subject to calibration, if deemed necessary.

#### 2. Low Pressure Air Test:

- a. Summary of Method: Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.
- b. Preparation of the Sewer Line: If required by Owner, flush and clean the sewer line prior to testing and cleaning out any debris. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested. Give special attention to laterals.
- c. Ground Water Determination: Install a ½ inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.
- d. Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828-90 or latest edition. The pressure-holding time is based on an average holding pressure of 3 psi gage or a drop from 3.5 psi to 2.5 psi gage.

Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gage. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gage, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi gage during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop has not occurred.

The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.

If the pipe to be tested is submerged in ground water, the test pressure shall be increased by 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer.

- e. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. In as much as a force of 250 lb. is exerted on an 8 inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

As a safety precaution, pressurized equipment shall include a regulator or relief valve set at no more than 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

- 3. All manholes will be tested using the negative air pressure test (vacuum) in accordance with ASTM C 1244-93 or latest edition for watertightness, and manhole will be visually inspected after backfilling. Contractor may backfill before testing with the understanding that any repairs will be made from the exterior of the manhole.

Sufficient pressure shall be applied in making the joint to assure that the pipe is "home".

The interior of the pipe shall be cleaned of all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.

g. Joining Pipe:

1) Ductile iron pipe to be joined as follows:

(a) Mechanical joint pipe

- (1) When installing PVC pipe into M.J. fittings, the beveled end of the pipe must be cut off to allow for maximum insertion depth and sealing area to avoid leaks. An approved joint restraint device is required when inserting PVC pipe into M. J. fittings. This device does not replace the requirements for a joint restraint system. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Lubricate the bell and spigot end of the pipe, using only approved lubricant (Blue Lube or Slikstyx). (Note: Use of any unapproved lubricant other than Blue Lube or Slikstyx has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The County will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.) Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Lubricate rubber gasket with approved lubricant as referenced above and place on the spigot end with thick edge toward the gland.
- (2) Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so

- (3) that it is located evenly around the joint. The gland is moved into position, bolts inserted and nuts screwed up finger tight, then tighten all nuts to torque listed below.

Bolts Size Inches	Torque-Ft. Lbs.
?	40 - 60
$\frac{3}{4}$	60 - 90
1	70 - 100
1 1/4	90- 120

- (4) Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed, and torque value is reached.
- (5) Permissible deflection in mechanical joint pipe shall not be greater than one-half of that listed in AWWA C600.

(b) Push-on joint Ductile Iron pipe

- (1) Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant (Blue Lube or Slikstyx), to the gasket and spigot end of the joining pipe. (Note: Use of any unapproved lubricant other than Blue Lube or Slikstyx has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The County will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.)
- (2) Start spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.
- (3) Permissible deflection in push-on joint pipe shall not be greater

**VDOT, CHESTERFIELD RESIDENCY - APRIL 1, 2004**  
**SUBDIVISION AND SITE CONSTRUCTION PLAN**  
**GENERAL NOTES**

1. All materials and construction within the public right of way or for roadways intended to be public rights of way shall be in accordance with current Virginia Department of Transportation specifications and standards.
2. Land Use Permit (CE-7) must be obtained from the Virginia Department of Transportation prior to beginning any construction within the existing state maintained right of way (including access).
3. VDOT is to receive written notification 48 hours prior to commencing with initial construction activities.
4. Prior to any construction, the contractor shall consult the engineer and verify the approval of the plans by all applicable federal, state and local agencies.
5. Preliminary design of the pavement structure for all subdivision streets shall be in accordance with the current edition of The Pavement Design Guide for Subdivision and Secondary Roads in Virginia. The completed design worksheet appendix IV shall be included with the initial plan submittal for each proposed pavement section utilizing the predicted soil support value shown in appendix I of The Pavement Design Guide.
6. The contractor shall verify the elevations of all points of connection or proposed work to existing curbs, sanitary lines, water lines, etc., prior to construction.
7. Upon discovery of soils that are unsuitable for foundations, subgrades, or other roadway construction purposes, the contractor shall immediately contact a geotechnical engineer and VDOT. These areas shall be excavated below plan grade as directed by a geotechnical engineer, backfilled with suitable material and compacted in accordance with current VDOT specifications.
8. All storm sewer design and construction to be in accordance with VDOT I & I LD-94 (D) 121.13.

9. All storm sewer pipes shall be reinforced tongue and groove concrete pipe in accordance with ASTM-C-76. Pipe within the right of way shall be a minimum CL-III or greater in accordance with current VDOT standards and specifications.
10. All pre-cast units shall be VDOT approved. Certification and VDOT stamp will be required on all units.
11. All concrete shall be class A3-AE (air entrained 3,000 PSI).
12. All entrances are to be designed and constructed in accordance with current VDOT standards. Residential lot access shall be provided per the following criteria:
  - All driveway entrance culverts are to be a minimum of 15" diameter x 20' long pipe and shall conform to PE-1 private entrance standards unless otherwise directed by the Resident Engineer. No entrance culverts are to be installed within five (5) feet of a property corner.
  - VDOT standard CG-9D entrances shall be installed in curb and gutter neighborhoods.

Inspections to be performed by VDOT shall be requested in writing, 48 hours prior to entrance installation.

13. The developer is responsible for furnishing and installing stop signs at street intersections, as well as, all signs deemed pertinent to the proposed development. The contractor shall contact the Richmond District Traffic Engineering office at 804-542-6000 to establish locations for any signage requirements as deemed necessary by VDOT inspector. Installation of said signs shall occur at no expense to the state and prior to state acceptance of roadway(s).
14. Design changes, specified materials changes and/or field changes from the approved plans need to be re-submitted to VDOT prior to proceeding with the work. A letter of explanation shall accompany the revised plans and/or drainage calculations, which must be submitted, to VDOT for review and approval by the Resident Engineer.
15. Contractor shall verify location and elevation of all underground utilities shown on plans in areas of construction prior to starting work. Contact engineer immediately if location or elevation is different from that shown on plan. If there appears to be a conflict, and/or upon discovery of any utility not shown on this plan, call Miss Utility of Central Virginia at 1-800-552-7001. The developer shall be responsible for the relocation of any utility within existing and/or proposed right of way required by the development.

16. All streetlights shall be located a minimum of 9.5' from the edge of pavement on curb and gutter streets and/or located a minimum of 5.5' behind the ditch line on open ditch streets.
17. Generally, paved roadside ditches are to be specified when velocities exceed current VDOT design criteria or when ditch slopes are less than 0.75%. Where ditch slopes exceed 5.0%, the developer may choose to implement erosion and sediment control measures in an attempt to achieve channel stabilization while acknowledging that additional paved ditch linings may be required prior to acceptance of the roads into the secondary system of state highways. Paved roadside ditches shall conform to VDOT-PG-2A standards and specifications.
18. VDOT approval of construction plans does not preclude the right to require additional facilities as deemed necessary for acceptance of the roads into the VDOT Secondary Road System.
19. VDOT approval of these plans will expire five (5) years from the date of approval.
20. VDOT shall have performed the required field inspection (proof roll) prior to placement of the aggregate base course(s). Contact VDOT, in writing, for subgrade inspection 48 hours prior to scheduling placement of aggregate base course(s).
21. A prime coat seal between the aggregate base and bituminous concrete will be required at a rate of 0.30 gallons per square yard (REC-250 Prime Coat) per VDOT standards and specifications.
22. The scheduling of aggregate base installation and subsequent paving activities shall accommodate forecast weather conditions per Section 315 of The Road and Bridge Specifications.
23. VDOT shall have approved the aggregate base course(s) for depth, template and performed the required field inspection (proof roll) prior to placement of any surface course(s). Contact VDOT, in writing, for inspection of the aggregate base course(s) 48 hours prior to application of the surface course(s).
24. An actual copy of the complete CBR report is to be submitted to VDOT in conjunction with final pavement designs. All pavement design recommendations shall be performed in accordance with the current edition of The Pavement Design Guide for Subdivision and Secondary Roads in Virginia.
25. A licensed geotechnical engineer shall ascertain cause and certify recommended method of repair for all pavement structural failures prior to state acceptance.

26. All vegetation and organic material is to be removed from the right of way limits prior to conditioning of the subgrade.
27. All materials shall be in accordance with the VDOT Road and Bridge Specifications and Road and Bridge Standards.
28. Dry gutter is not allowed in VDOT right of way.
29. The developer will be responsible for the design costs of any traffic signal installation and/or modification under an account receivable with VDOT.
30. The necessity and locations for additional VDOT standard underdrains to be determined at time of subgrade inspection.
31. Approval of a detailed construction sequencing/maintenance of traffic narrative for the work zone is a prerequisite for issuance of a Land Use Permit allowing access to and construction within VDOT maintained right-of-way.
32. VDOT shall be provided documentation by a licensed geotechnical engineer, certifying that all in-place pavements meet or exceed the approved pavement design thickness prior to state acceptance. The certifying documentation shall conform to VDOT specifications and the approved plans.
33. The establishment of a temporary vegetative cover is required on all denuded areas that are not to be fine graded for periods longer than 30 days.
34. No structure shall be constructed on state maintained rights of way unless said structures are shown on road construction plans approved by VDOT or covered by a VDOT Land Use Permit (or by a letter of intent from the Resident Engineer to issue said permit at the time of state acceptance).
35. The developer is responsible for contacting the Richmond District Traffic Engineering section at 804-524-6000 for guardrail location and placement requirements.
36. A preconstruction meeting is required prior to undertaking any roadway construction activities. Developer or designee will contact Chesterfield Residency, in writing, five working days in advance of anticipated construction start to establish date, time and location for preconstruction meeting. The primary function of the construction meeting will be to identify geotechnical parameters of proposed construction activities.

- d. Power Seal Model # 3501 (long barrel coupling)
  - e. Maxi Fit (long sleeve coupling)
  - f. Ford FC2W (Wide Range)
- 2. Cast D.I. Couplings
  - a. FEHR
- J. Air Release or Combination Air Release and Vacuum Valves**  
(Engineer is responsible for specifying the appropriate type for its designated use)
  - 1. Clow 5401-E (for 2" inlet with small orifice)
  - 2. Clow 5402-A (for 1" inlet and 1" orifice)
  - 3. APCO (Product Bulletin No. 600 and/or 601)
  - 4. G. A. Industries Type 1 GH4-150 Type 4 GH 7-K
  - 5. Valmatic
  - 6. Cla Val (Models 34, 35 & 36)
- K. Blow Off Valves**
  - 1. 2" Bronze Gate Valve  
(open to most manufacturers, i.e., Grinell, Epsco, etc.)
- L. Line Stopping Valves**
  - 1. Hydra-Stop
- M. Water Meter Boxes/Vaults**
  - 1. Precast Concrete Box:
    - a. Lyttle Service Co. LLC T/A Stamie E. Lyttle Co., Inc.  
(used with 1", 1½" or 2" water meters and assemblies)
    - a. Clear Flow Model CFLD6060 (for 3" and 4" water meters and assemblies)
    - b. M&B - Model #MB1500BF/WM (for 3" and 4" water meters and assemblies)

6. Cascade - Styles CNS2 (for 12" and smaller pipe), CBS2 (for 12" and smaller pipe), and CDSLDD (large diameter saddles for 16" and larger pipe)
7. Mueller - Models DB2S & DE2S (with double straps for 2"-12")

**Q. Pipe Restraints (must be UL Listed and FM Approved)**

1. For PVC Pipe (Sizes up to 12")
  - a. Megalug Series 2000 PV (PVC Pipe - MJ Fittings)  
Megalug Series 1500 (PVC Bell and Spigot Joints)
  - b. Romac Style 611 (PVC Bell and Spigot Joints)
  - c. Uni-Flange Series 1390-C (PVC Bell and Spigot Joints)  
Uni-Flange Series 1500 (PVC Pipe - MJ Fittings)
  - c. STARGRIP Series 3600 (PVC Pipe - MJ Fittings)
  - d. AquaGrip Intergral Restraint System for use on the Centurion Fire Hydrants and Mueller RS Valves
  - e. SIGMA One-Lok Model SLC
2. For Ductile Iron Pipe -
  - a. Megalug 1100 Series (MJ Fittings) All Sizes
  - b. Uni-Flange Series 1400 Block Buster Wedge Action Retainer Glands (MJ Fittings) Sizes 4"-24"
  - c. Uni-Flange Series 1390-C (Bell and Spigot Joints) Sizes 6"-16"
  - d. STARGRIP Series 3000 (MJ Fittings) Sizes 4"-48"  
STARGRIP Series 3600 (MJ Fittings) Sizes 4"-12"
  - e. RomaGrip Sizes 4"-12"
  - f. SIGMA One-Lok Model SLD (MJ Fittings) Sizes 4"-36"

## **SECTION 2:        SANITARY SEWER SYSTEM**

### **A.    Pipes - Gravity**

1.    Concrete
  - a.    Circular Reinforced (ASTM C76)
2.    PVC Sanitary Sewer Pipe SDR35 (ASTM D3034 6" - 15")
3.    PVC Sanitary Sewer Pipe Envrio-Tite SDR 35 (ASTM F1760 6"-15")
4.    PVC Sanitary Sewer Pipe SDR 35 (ASTM F679, 18"-48"), T1 Wall Thickness
5.    Perma Loc (21"-36") Series 46 with minimum wall thickness of 17"
6.    Ultra Rib (21"-36") with minimum wall thickness of .17"
7.    Ductile Iron Pipe Class 52 Minimum or higher classification depending upon design consideration. (Push-On and Mechanical Joint) (6", 8", 10", 12", 16", 20", 24", 30" & 36")
8.    Carlon Vylon H.C. - a.k.a. Lamson Pipe (21"-48") with minimum wall thickness of .17"
9.    Ultra-Corr PVC Pipe (24"-36") with minimum wall thickness of .17"

### **Pipe - Pressure**

1.    C-900 or C-909 - P.V.C. (DR-18, CL. 150) (Sizes 6", 8" & 12")
2.    a.    Class 52 minimum or higher classification depending upon design consideration. (Push-on and Mechanical Joint) (6", 8", 12", 16", 20", 24", 30" & 36")
  - b.    Restrained Joint Pipe (Pipe Application: Use only where mechanical joint pipe is not available or in vertical applications).

- 1) Griffin Snap-Lok (6" - 30")
- 2) American D.I. Pipe Flex-Ring (6" - 36")
- 3) U.S. Pipe TR-FLEX (6" - 36")
- 4) Clow Super Lock (30" - 36")
- 5) McWane D. I. (30" - 36")

3. HDPE - DR 11 (4" - 8" only)

**B. Manholes, Precast Concrete (ASTM C478)**

1. Hanson Pipe & Products
2. Americast
3. Concrete Specialties, Inc.

**C. Frames and Covers**

1. Manhole
  - a. Street Type (MH-1-S)
    - 1) Neenah Foundry
    - 2) Capitol Foundry
    - 3) Sigma Corporation
    - 4) East Jordan Iron Works
    - 5) FasTech
  - b. Watertight
    - 1) Capitol MH 1-S/WT
    - 2) East Jordan Iron Works
    - 3) FasTech

**D. Fittings (Gasketed) - Gravity**

1. Concrete
  - a. Circular Reinforced (ASTM C76)
    - 1) Hanson Pipe & Products
  - b. Kor-N-Tee
  - c. Inserta Tee

2. PVC Sanitary Sewer Fittings (ASTM D3034 SDR35 6" - 27")
  - a. Certain-Teed Products Corporation
  - b. J-M Manufacturing Co.
  - c. The Harrington Corporation (HARCO)
  - d. GPK Products, Inc.
  - e. Vassallo
  - f. Multi-Fittings
  - g. Scepter-Canron, Inc. (IPEX)
  - h. Plastic Trends, Inc.
  - i. Nyloplast USA, Inc.
  - j. Freedom Plastics, Inc.

**Fitting (D.I. Only) Pressure**

1. D.I. Compact AWWA C153 or D.I./C.I. AWWA C110
2. D.I. Special Coated Compact Fittings AWWA 153

**E. Adaptors**

1. Fernco Pipe Adaptors - (Used only when installing 6" connections where 6" connection is of Ductile Iron material)
2. GPK Manhole Adaptors (See MAN-16)
  - a. GPK manhole adaptor adapting PVC pipe to concrete with quick quete for manholes with BUO's.
  - b. GPK PVC drop manhole cross with manhole adaptors (6" and 8" only) strapped to manhole.
3. DFW/HPI Nonshear Coupling (Used only at the direction of the County Inspector where pipe transitioning is necessary due to unlike pipe materials.)

## **F. Gaskets & Flexible Manhole Connectors**

1. Kor-n-seal Connector, NPC Systems, Inc.
2. "O" Ring Gasket
3. Flat Gasket for Watertight Manholes
4. Press-Boot Connector, Press-Seal Gasket Corp.
5. Profile RS or Type 4G Gaskets, Press-Seal Gasket Corp.
6. IPS Adjustable, Cobra, or Toggle styles

## **G. Saddles**

1. The General Engineering Company (GENECO) Sealtite Model H with Bell End for SDR-35 PVC
2. ROMAC CB Sewer Saddle
3. Inserta Tee

## **H. Steps, Manhole**

1. MA Industries, Inc.  
Style No. PS1-PF
2. Bowco Industries, Inc.  
Model #93810 (48" and 54" Dia. M.H.'s)  
Model #93813 (60" Dia. M.H.'s and Larger)
3. Press Seal  
Model #P-10938 (48" and 54" Dia. M.H.'s)  
Model #P-14850 (60" Dia. M.H.'s and Larger)
4. Cosmos North America  
Model #US-10-OH
5. American Step Company  
Model #ML-10 (Standard Grade)

## **I. Stoppers (Plugs)**

1. For PVC Sanitary Sewer Pipe (with wing nuts and ears)
  - a. Certain-Teed Products Corporation
  - b. Cherne

2. For D.I. Pipe (Slip Joint Plug)
  - a. Griffin Pipe Products
  - b. Tyler
  - c. Union Foundry
  - d. Harrington Corporation (HARCO)
  - e. Standard International
  - f. Trinity Valley
  - g. American Cast Iron
  - h. U. S. Pipe and Foundry
  - i. Cherne

**J. Valves**

1. Sewage Air/Vacuum Release Valves
  - a. Vent-O-Mat Series RGX or RGS<sub>b</sub> - "Anti-Surge"  
(Note: Engineer must design project using the appropriate valve.)
2. Plug Valves
  - a. DeZurik Series 100 [Figure 118] -  
(Non-Lubricated Eccentric)
  - b. Val-Matic Series 5900 or 5800 Cam-Centric
  - c. Milliken - Millcentric (Eccentric Plug Valve)
  - d. Homestead Eccentric Plug Valve - Series 120
  - e. Clow Eccentric Plug Valve (3"-24")

**K. Manhole Adjusting Rings**

1. Concrete Reinforced
2. LadTech H.D.P.E.

**B.     SANITARY SEWER SYSTEMS**

**PVC SDR-35 GRAVITY SEWER PIPE (SIZES 6", 8", 10" 12" & 15") ASTM D3034**

**MANUFACTURERS:**

ASTM D3034	1.	Certainteed Corporation P.O. Box 860 Valley Forge, PA 19482	(610) 341-7000 FAX (610) 341-6837
ASTM D3034	2.	PW Eagle, Inc. (formerly Uponor ETI Company) P.O. Box 709 Buckhannon, WV 26201	(800) 624-3111 FAX (304) 472-0742
ASTM D3034	3.	J-M Manufacturing Co., Inc. (J.M.) 9 Peach Tree Hill Road Livingston, NJ 07039	(201) 535-1633
ASTM D3034 ASTM F1760	4.	IPEX, Inc. (frmly Scepter-Canron) 2441 Royal Windsor Drive Mississauga, Ontario, Canada L5J4C7	(800) 463-9572 FAX (905) 401-9195
ASTM D3034	5.	Diamond Plastics Corporation 1212 Johnstown Road P.O. Box 1608 Grand Island, NE 68802	(308) 384-4400 FAX (308) 384-9345
ASTM D3034	6.	North American Pipe Corporation (NAPCo) 200 Park Place Booneville, MS 38829	(601) 728-2111 FAX (601) 728-3135
ASTM D3034	7.	Bristolpipe A Heywood Williams Company 601 County Road 17 P.O. Box 1868 Elkhart, IN 46515	(800) 348-7671 (219) 295-4515 FAX (800) 272-7044
ASTM D3034	8.	National Pipe & Plastics, Inc. 9609 Old Highway 421S Colfax, N. C. 27235	(800) 866-0149 FAX (336) 996-1755

PVC SDR-35 GRAVITY SEWER PIPE (Sizes 18"-48") ASTM F679

MANUFACTURERS:

- |    |  |                                      |
|----|--|--------------------------------------|
| 1. | Certaineed Corporation<br>P.O. Box 860<br>Valley Forge, PA 19482               | (610) 341-7000<br>FAX (610) 341-6837 |
| 2. | Condux Pipe Systems<br>P.O. Box 789<br>Mankato, MN 56002                       | (507) 387-2284                       |
| 3. | J-M Manufacturing Co., Inc.<br>9 Peach Tree Hill Road<br>Livingston, NJ 07039  | (201) 535-1633                       |
| 4. | North American Pipe Corp.<br>200 Park Place<br>Booneville, MS 38829            | (601) 728-2111<br>FAX (601) 728-3135 |
| 5. | National Pipe & Plastics, Inc.<br>9609 Old Highway 421S<br>Colfax, N. C. 27235 | (800) 866-0149<br>FAX (336) 996-1755 |

**ULTRA-RIB PVC GRAVITY SEWER PIPE (21"-36") ASTM F794**

MANUFACTURERS:

1. PW Eagle, Inc. (800) 624-3111  
(formerly Uponor ETI Company) FAX (304) 472-0742  
P.O. Box 709  
Buckhannon, WV 26201

PERMA-LOC, PVC GRAVITY SEWER PIPE (21"-36") ASTM F794 Series 46

MANUFACTURERS:

1. J-M Manufacturing Co., Inc. (201) 535-1633  
9 Peach Tree Hill Road  
Livingston, NJ 07039

**CARLON VYLON H.C. GRAVITY SEWER PIPE (21"-48") ASTM F794**

MANUFACTURERS:

1. Carlon, A Lamson & Sessions Company (216) 831-4000  
25701 Science Park Drive (800) 321-1970  
Cleveland, OH 44122 FAX (216) 831-3208

## **ULTRA-CORR GRAVITY SEWER PIPE (24"-36") ASTM F794**

### **MANUFACTURERS:**

1. PW Eagle, Inc. (800) 624-3111  
(formerly Uponor ETI Company) FAX (304) 472-0742  
P.O. Box 709  
Buckhannon, WV 26201

## **CONCRETE GRAVITY SEWER PIPE**

### **MANUFACTURERS:**

1. Hanson Pipe & Products, Inc. (800) 309-1202  
2900 Terminal Avenue (804) 233-5471  
Richmond, VA 23234-1632 FAX (804) 232-1213
2. Hydro Conduit Corporation (919) 475-1371  
208 Randolph Street, P.O. Box 818  
Thomasville, N.C. 27360-0818

## **DUCTILE IRON GRAVITY SEWER PIPE**

### **MANUFACTURERS:**

1. Same as for Approved Water Pipe Manufacturers for PVC and Ductile Iron

## **PRESSURE SEWER PIPE**

### **MANUFACTURERS:**

1. Same as for Approved Water Pipe Manufacturers
2. For HDPE:  
  
DriscoPlex Performance Pipe, a Div. of (800) 527-0662  
Chevron Phillips Chemical Company LP FAX (972) 599-7348  
PO Box 269006  
Plano, TX 75026-9006

## **PVC SDR-35 GASKETED GRAVITY SEWER FITTINGS**

### **MANUFACTURERS:**

1. Head Manufacturing, Inc. (208) 852-2000  
640 South Highway 91 FAX (208) 852-2003  
Preston, ID 83263-9738  
(Formerly Certainteed Corp. Fittings)

2. J-M Manufacturing Co., Inc. (201) 535-1633  
9 Peach Tree Hill Road  
Livingston, NJ 07039
3. Vassallo, Inc. (813) 676-7975  
P.O. Box 567 (800) 237-6215  
State Route 60 West FAX (813) 676-0216  
Lake Wales, FL 33853
4. The Harrington Corporation (HARCO) (804) 845-7094  
P.O. Box 10335  
Lynchburg, VA 24506
5. Multi-Fittings, Inc. (800) 344-5819  
731 Langco, Suite 101  
Richardson, TX 75281
7. GPK Products, Inc. (800) 437-4670  
1601 43rd. Street NW FAX (800) 822-6989  
Fargo, ND 58102
8. Plastic Trends, Inc. (216) 825-4053  
3718 Golf Course Drive FAX (216) 825-7357  
Norton, OH 44203
9. Nyloplast USA, Inc. (404) 932-2443  
3130 Verona Avenue FAX (404) 932-2490  
Buford, GA 30518
10. Freedom Plastics, Inc. (608) 754-2710  
P.O. Box 1488  
Janesville, WI 53547

#### **CONCRETE GRAVITY SEWER FITTINGS**

##### **MANUFACTURERS:**

1. Hanson Pipe & Products, Inc. (800) 309-1202  
2900 Terminal Avenue (804) 233-5471  
Richmond, VA 23234-1632 FAX (804) 232-1213

#### **PRESSURE SEWER FITTINGS**

##### **MANUFACTURERS:**

1. Same as approved for water pipe.

## **MANHOLE RISERS (R), CONES (C) and ADJUSTING RINGS (AR)**

### **MANUFACTURERS:**

- |        |    |  |  |
|--------|----|--|--|
| R,C,AR | 1. | Hanson Pipe & Products, Inc.<br>2900 Terminal Avenue<br>Richmond, VA 23234-1632                                  | (800) 309-1202<br>(804) 233-5471<br>FAX (804) 232-1213 |
| R,C,AR | 2. | Americast,<br>A Division of Valley Blox, Inc.<br>P.O. Box 432<br>210 Stone Spring Road<br>Harrisonburg, VA 22801 | (800) 548-4586   |
|        |    | Americast,<br>A Division of Valley Blox, Inc.<br>11352 Virginia Precast Road<br>Ashland, VA 23005                | (804) 798-6068   |
| R,C,AR | 3. | Concrete Specialties, Inc.<br>1420 16th. Street N.E.<br>Roanoke, VA 24014  | (703) 982-0777<br>FAX (703) 982-0775                   |
| AR     | 4. | LADTECH, Inc.<br>244 Woodbridge Lane<br>Lino Lakes, MN 55014   | (651) 415-1252<br>FAX (651) 415-1090                   |

## **MANHOLE FRAMES AND COVERS**

### **MANUFACTURERS:**

- |  |    |  |  |
|--|----|--|--|
|  | 1. | Capitol Foundry<br>2856 Crusader Circle<br>Virginia Beach, VA                  | (804) 427-9431   |
|  | 2. | Neenah Foundry<br>P.O. Box 729<br>Neenah, WI 54959                             | (414) 725-7000<br>FAX (414) 729-3682                   |
|  | 3. | SIGMA Corporation<br>700 Goldman Drive, P. O. Box 300<br>Cream Ridge, NJ 08514 | (609) 758-0800<br>(800) 999-2550<br>FAX (609) 758-1158 |
|  | 4. | East Jordan Iron Works, Inc.<br>P.O. Box 245<br>Finksburg, MD 21048            | (800) 418-3549   |

- (904) 474-0211  
FAX (904) 474-0277

MANUFACTURERS:

1.	GENECO (The General Engineering Co.)	(301) 663-9282
	Box 609	(800) 345-6454
	Frederick, MD 21701	FAX (301) 695-5612
2.	GPK Products, Inc.	(800) 437-4670
	1601 43rd. Street NW	FAX (800) 822-6989
	Fargo, ND 58102	
3.	DFW/HPI	(800) 255-7633
	P.O. Box 648	FAX (817) 488-4412
	Bedford, TX 76095	

1.	Certainteed Corporation	(215) 341-7000
	P.O. Box 860	
	Valley Forge, PA 19482	
2.	Cherne Industries, Inc.	(800) 843-7584
	5701 South County Road 18	(612) 933-5501
	Minneapolis, MN 55436	FAX (612) 938-6601

(FMC)	1.	NPC Systems, Inc. Elm Street, Box 301 Milford, NH 03055	(603) 673-8680
(G) (FMC)	2.	Press-Seal Gasket Corporation P.O. Box 10482 Fort Wayne, IN 46852	(800) 348-7325 FAX (219) 436-1908
(G)	3.	Fowler Manufacturing Company P.O. Box 767 Hillsboro, OR 97123	(503) 357-2110

(FMC) 4. International Precast Supply (800) 845-3537  
60 Railroad Street FAX (978) 372-2831  
Haverhill, MA 01835

**SEWER SADDLES with approved gaskets**

1. ROMAC Industries, Inc. (800) 426-9341  
1064 4th. Avenue S.  
Seattle, WA 98134
2. GENEKO (The General Engineering Co.) (301) 663-9282  
Box 609 (800) 345-6454  
Frederick, MD 21701 FAX (301) 695-5612
3. INSERTA Fittings Company (503) 357-2110  
P.O. Box 767 FAX (503) 359-5417  
Hillsboro, OR 97123

**AIR/VAC AND COMBINATION VALVES**

1. Mulric Hydro Projects (027 11 International) 748-0287  
(VENT-O-MAT) FAX (027 11 International) 422-3078  
P.O. Box 16091  
Atlasville, 1465 South Africa

**PLUG VALVES**

1. Dezurik (612) 259-2000  
250 Riverside Avenue North  
Sartell, MN 56377
2. Val-Matic Valve and Manufacturing Corp. (708) 941-7600  
905 Riverside Drive FAX (708) 941-8042  
Elmhurst, IL 60126
3. Milliken Valve Company, Inc. (215) 861-8803  
3864 Courtney Street, Suite 100 FAX (215) 861-8094  
Bethlehem, PA 18017
4. Homestead (215) 770-1100  
160 Walnut Street FAX (215) 770-1108  
Allentown, PA 18102
5. Clow Valve Company, A Div of McWane, Inc. (714) 735-5555  
1375 Magnolia Avenue FAX (714) 735-0837  
Corona, CA 91719

## MANHOLE STEPS

1. MA Industries, Inc. (404) 487-7761  
P.O. Box 2322 FAX (404) 631-4679  
Peachtree City, GA 30269
2. BOWCO Industries, Inc. (800) 232-7837  
P.O. Box 22315 FAX (503) 653-8934  
Portland, OR 97222
3. Press-Seal Gasket Corporation (800) 348-7325  
P.O. Box 10482 FAX (219) 436-1908  
Fort Wayne, IN 46852
4. Cosmos North America (202) 333-3955  
P.O. Box 25532 FAX (202) 333-6427  
Washington, DC 20007
5. American Step Company (800) 988-STEP  
P.O. Box 137 FAX (770) 467-8011  
Griffin, GA 30224-0137

## SECTION 4: MATERIALS SPECIFICATIONS

All products must comply with the Materials Specifications as referenced in Part IV herein, and the Standard Details as reflected in the Department of Public Utilities' Standard Design Specifications and Details Manual. All references to ASTM, AWWA, and other standards shall include latest revisions. In addition, all products must have the approval of the State Health Department prior to the submittal to the PDRC for consideration.

### A. WATER SYSTEMS

#### 1. Water Pipe and Fittings:

- a. Ductile iron pipe shall meet the requirements of AWWA C151. Pipe shall be thickness Class 51. Pipe shall have cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA Standard C104. Thickness class shall meet the requirements of AWWA C150. Minimum wall thickness for pipe shall be as follows: 6"-0.28", 8"-0.30", 12"-0.34", 16"-0.37", 20"-0.39", 24"-0.41", 30"-0.47". A minimum of 5% of the pipe furnished shall be gauged for roundness full length and so marked.
- b. Pipe fittings shall meet the requirements of AWWA C110 (ductile iron or cast iron) or AWWA C153 (ductile iron compact). All fittings shall be Pressure Class 250. Fittings shall have a cement-mortar lining and a bituminous seal coating or a 6-8 mil (nominal thickness) fusion bond epoxy lining/coating in compliance with AWWA C550.
- c. Pipe and fittings shall have either mechanical joint or push-on joint, both conforming to the requirements of AWWA C111. Bolts shall be high strength cast iron having an ultimate tensile strength of 75,000 psi and a minimum yield point of 45,000 psi.
- d. Polyvinyl chloride pipe (PVC) 6", 8", and 12" in size shall conform to the requirements of AWWA Specification C-900, with gasket joints, DR-18 Class 150 with iron pipe O.D. Fittings shall be ductile iron or cast iron, Pressure Class 250, with mechanical joints. Additional criteria as set forth by the County of Chesterfield is outlined in Section 4.C.1. entitled "Supplemental Specifications - Additional Criteria for Polyvinyl Chloride Piping for Water and Sanitary Sewer Systems".
- e. Prestressed concrete cylinder pipe with rubber and steel joint shall conform to AWWA Specification C-301. All fittings and pipes shall be cement-lined and emulsion treated.

## B. SANITARY SEWER SYSTEMS

### 1. Gravity Sewer and Force Main Pipe and Fittings:

- a. Reinforced concrete (non-pressure) pipe, fittings and specials shall meet requirements of ASTM C76 minimum Class II unless stronger pipe is required by the plans and specifications. Pipe ends shall have O-ring gasket groove provided during manufacturing process.

Rubber gaskets and joints of concrete pipe shall meet requirements of ASTM C361.

Pipe and joints shall be tested in accordance with Section 11 of ASTM C76 and ASTM C443. If requested by Department of Public Utilities or Engineer, test reports shall be submitted to the Engineer.

- b. Polyvinyl chloride (PVC) (non-pressure) pipe (6"-15") and fittings shall meet requirements of ASTM D3034 Type PSM SDR-35 or ASTM F1760 SDR-35 with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipes as shown in the County's Standard of Details. Additional criteria as set forth by the County of Chesterfield is outlined in Section 4.C.1. entitled "Supplemental Specifications - Additional Criteria for Polyvinyl Chloride Piping for Water and Sanitary Sewer Systems".
- c. Polyvinyl Chloride (PVC) (non-pressure) pipe (18"-48") and fittings shall meet requirements of ASTM F679, Table I Type SDR-35 for large diameter solid wall PVC pipe with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipes as shown in the County's Standard of Details.
- d. Perma-Loc (Series 46) PVC (non-pressure) sewer pipe (21"-36") and fittings shall meet requirements of ASTM F794 specification for large diameter ribbed sewer pipe with elastometric gasket joints meeting requirements of ASTM D3212 and fittings based on controlled inside diameter. Bedding shall be as required by the County for plastic pipes as shown in the County's Standard of Details.

- e. Ultra-Rib PVC Gravity (non-pressure) sewer pipe (21"-36") shall meet requirements of ASTM F794 and fittings shall meet the requirements of ASTM 3034-35 PVC sewer pipe with elastomeric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipes as shown in the County's Standard Details.
- f. Carlton Vylon H.C. PVC Gravity (non-pressure) sewer pipe (21"-48") shall meet requirements of ASTM F794 and fittings shall meet the requirements of ASTM 3034-35 PVC sewer pipe with elastomeric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipes as shown in the County's Standard Details.
- g. Ultra-Corr PVC sewer (non-pressure) pipe (24"-36") shall be seamless profile wall and meet the requirements of ASTM F794 and fittings shall meet the requirements of ASTM 3034-35 PVC sewer pipe with elastomeric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipes as shown in the County's standard details. Pipe shall have a smooth interior with a corrugated cross-sectional rib exterior. Exterior corrugations shall be perpendicular to the axis of the pipe to allow placement of the sealing gasket without field marking, beveling, sealing channels, gluing, welding, additional cutting or machining. The pipe stiffness shall be a minimum of 50 psi when tested at 5% deflection in accordance with D2412. Pipe shall be green in color.
- h. Ductile iron (gravity or pressure) pipe shall meet requirements of AWWA C151. Pipe shall be thickness Class 52. Pipe shall have cement-mortar lining and a bituminous seal coat. Thickness classes shall meet requirement of AWWA C150.
- i. Pressure Pipe and fittings shall have either mechanical joint or push-on joint, both conforming to the requirements of AWWA C111. Bolts shall be high strength cast iron having an ultimate tensile strength of 75,000 psi and a minimum yield point of 45,000 psi.
- j. Pressure Pipe fittings shall meet the requirements of AWWA C110 (ductile iron or cast iron) or AWWA C153 (ductile iron compact). All fittings shall be Pressure Class 250. Fittings shall have a cement-mortar lining and a bituminous seal coating or a 6-8 mil (nominal thickness) fusion bond epoxy lining/coating in compliance with AWWA C550.

- k. Pressure Polyvinyl chloride pipe (PVC) 6", 8", and 12" in size shall conform to the requirements of AWWA Specification C-900, with gasket joints, DR-18 Class 150 with iron pipe O.D. Fittings shall be ductile iron or cast iron, Pressure Class 250, with mechanical joints. Additional criteria as set forth by the County of Chesterfield is outlined in Section 4.C.1. entitled "Supplemental Specifications - Additional Criteria for Polyvinyl Chloride Piping for Water and Sanitary Sewer Systems".
- l. Push-on-joint and rubber gasket shall meet requirements of AWWA C111.
- m. Cement mortar lining with bituminous seal coat for ductile iron pipe and fittings shall meet requirements of AWWA/ANSI C104/A21.4.  
  
Cement mortar lining shall be standard thickness.
- n. Exterior bituminous coating for cast iron fittings and ductile iron pipe shall meet requirements of AWWA/ANSI C106/A21.6 or AWWA/ANSI C151/A21.51 as applicable.

## **2. Sanitary Sewer Manholes:**

- a. Manholes shall be constructed of precast reinforced concrete manhole sections in accordance with requirements of ASTM C478 and as shown on the Standard Details.
- b. A maximum of two lift holes per manhole section may be provided.
- c. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket or Press Seal, Inc's Profile RS gasket.  
  
Gasket shall comply with requirements of ASTM C361.  
  
Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.
- d. Provide flexible pipe connections to manholes for pipes 21 inches in diameter and smaller in size.

Materials shall consist of EPDM and elastomers designed to be resistant to water, sewage, acids, ozone, weathering and aging. Use neoprene conforming to ASTM C443 and ASTM C923 and all stainless steel elements of the connector shall be totally non-magnetic Series 304 Stainless, excluding the worm screw for tightening the steel band around the pipe which shall be Series 305 Stainless. The worm screw for tightening the steel band shall be torqued by a break-away torque wrench available from the precast manhole supplier, and set for 60 - 70 inch/lbs.

Cast or core drill openings in manholes to receive connectors. Connectors shall be suitable for field repair or replacements. Connectors not suitable for field replacement are unacceptable.

The assembled connectors shall allow at least an 11° angular deflection of the pipe and at least one inch of lateral misalignment in any direction and be suitable for a normal variation in diameter or roundness for the pipe material used.

Connectors shall be Kor-N-Seal as manufactured by National Pollution Control Systems, Inc. or approved equal.

- e. Manhole steps shall be corrosion-resistant and shall be one-half inch grade 60 steel reinforcing rod encapsulated in a copolymer polypropylene. The steps shall conform with ASTM C478 paragraph 11 and to the dimensions shown on the Standard Details.
- f. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall not be coated. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown on the Standard Details.
- g. Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika "Sikaflex" type 430.
- h. Sealant for flexible pipe connections shall be a two-component polysulfide sealant similar to Sika "Sikaflex" type 412 with primer type 419.
- i. All manholes shall be watertight.

3. **Sewage Air/Vacuum Break Valves without Bias Mechanism** - All valves shall be designed in accordance with the following standard and/or by the Engineer as required:

The Sewage Air Release and Vacuum Break Valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in H.D.P.E. - stainless steel nozzle and woven dirt inhibitor screen, nitrile rubber seals and natural rubber seat.

The valve shall have an integral "Anti-Surge" Orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to less than 1.5x valve rated working pressure.

The intake orifice area shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice.

Large orifice sealing shall be effected by the flat face of the control float seating against a nitrile rubber 'O' ring housed in a dovetail groove circumferentially surrounding the orifice.

Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented.

The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure.

Connection to the valve inlet shall be facilitated by flanged ends conforming to ANSI B16.1 Class 125 or Class 250 Standards.

Flanged ends shall be supplied with the requisite number of stainless steel screwed studs inserted for alignment to the specified standard. **Nuts, washers, or jointing gaskets shall be excluded.**

4. **Sewage Air/Vacuum Break Release Valves with Bias Mechanism** - All valves shall be designed in accordance with the following standard and/or by the Engineer as required:

The Sewage Air Release and Vacuum Break Valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in H.D.P.E. - stainless steel nozzle and woven dirt inhibitor screen, nitrile/E.P.D.M. rubber seals and natural/E.P.D.M. rubber seat.

The valve shall have an integral 'Anti-Surge' Orifice mechanism which shall operate automatically to limit surge pressures or shock induced by liquid oscillation and/or rapid air/gas discharge to less than 1.5x valve rated working pressure.

The intake orifice area shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice. Large orifice sealing shall be effected by the flat face of the control float seating against a nitrile/E.P.D.M. rubber 'O' ring housed in a dovetail groove circumferentially surrounding the orifice.

Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural/E.P.D.M. rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented.

The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure.

Connection to the valve inlet shall be facilitated by flanged ends conforming to ANSI B16.1 Class 125 and Class 250 and ANSI B16.5 Class 150 and Class 300 Standards.

Flanged ends shall be supplied with the requisite number of stainless steel screwed studs inserted for alignment to the specified standard. **Nuts, washers, or jointing gaskets shall be excluded.**

## **5. Sewage Plug Valves**

- a. All plug valves shall be of the non-lubricated, eccentric type with resilient faced plug and round ports of no less than 90%, or rectangular ports of no less than 80%, of the connecting pipe area, except valves of 24" or larger size shall have port areas of no less than 70% of the connecting pipe area.

- b. Valves shall be for buried underground service as well as plant service and shall be rated for 175 psi up to 12" and 150 psi for sizes 14" and larger. Drop-tight shut off shall be provided at full rated working pressure in the standard flow direction and 50 psi in the reverse direction, except when full-rated sealing is required in both directions.
- c. Valves 6" and larger shall be equipped with geared actuators with a 2" square operating nut. Handwheel and power actuated valves shall also include a 2" square operating nut for emergency operation.

All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.

Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.

- d. Valves shall open left (counterclockwise) and shall have mechanical joint end connections, or as specified by the Department of Public Utilities.
- e. Valve bodies and all other cast iron parts shall conform in all respects to the American Society for Testing Materials' Standard Specifications of Gray Iron Castings, ASTM Specification Designation A-126, Class B. The castings shall be clean and perfect without blow or sand holes or defects of any kind. No plugging or stopping of holes will be allowed.

Body ends shall be flanged with facing and drilling in accordance with ANSI B16.1, Class 125 or mechanical joint in accordance with AWWA Standard C-111 or ANSI A21.11. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets and glands).

- f. Valve bodies shall be furnished with a raised seat surface completely covered with 90% pure nickel to insure that the resilient plug face contacts only nickel, or a one-piece 304 stainless steel seat ring threaded to the body. The nickel seat must be welded to the valve body or the body seat ring to produce a metallurgical bond with interpenetration to the base metal with a bond strength equal to or greater than the valve body or seat ring material. The nickel or stainless steel seat must be machined to a finish of not more than 16 micro-inches to achieve minimal friction and wear to the resilient plug face during valve operation. Whether welded or screwed, the valve seat shall be designed to provide uniform contact with the resilient plug face and to prevent the plug face from contacting any cast iron surface. Resilient seats or seats attached to the body by screws or any other method not specified herein are not acceptable. Plated or sprayed nickel seats or epoxy seats are not acceptable.
- g. Valve bodies shall be furnished with an adjustable closed position stop. The seat end and standard flow direction shall be cast onto the valve body.
- h. Resilient faced plug/operating shaft shall be of a one piece design of ASTM A126 Class B cast iron with a seating surface eccentrically offset from the center of the plug shaft, and shall have a precision molded resilient facing of chloroprene (Neoprene), Buna-N (nitrile) or nitrile-butadiene (Hycar). With the valve in the open position, all surfaces of the plug/shaft shall be substantially out of the fluid flow path.
- i. Valve shaft journal bearings shall be sleeve type, sintered, oil impregnated, permanently lubricated, type 316 ASTM A743 grade CF-8M or AISI type 317 L stainless steel, or phenolic backed Teflon. Thrust bearings shall be located in the upper and lower journal areas and shall consist of stainless steel, Teflon, or a combination of those materials. Grit seals shall be provided in the upper and lower journals to prevent abrasive material from entering the bearing and seal areas.
- j. Valve shaft seals shall conform to AWWA Standard C504-87, Section 3.7 and shall be of the bronze cartridge type utilizing O-rings, or the adjustable multiple V-ring type and shall be replaceable without disassembling the valve, while the valve is under system pressure.

- k. Valve interiors and exteriors shall be coated according to AWWA Standard C550-90 with a two-component high build epoxy suitable for potable water service, with interior surfaces receiving 8 - 10 mils (dry film thickness) and exterior surfaces receiving 3 - 5 mils (dft) or 8 - 10 mils (dft) hand-applied epoxy coating. For buried or submerged service, 8 - 10 mils (dft) of asphalt varnish may be substituted for the exterior coating.
- l. Valve testing shall be conducted per AWWA C504-87 Section 5, covering rubber seated butterfly valves. Each valve shall be performance tested per paragraph 5.2 assuring valve operation.

Body seat and shell leakage testing is to be conducted on each valve as per paragraphs 5.3 and 5.4.

Proof of design testing shall be conducted per paragraph 5.5 and witnessed by a third party inspection agency. Certified copies of this report shall be available upon request.

- m. Eccentric plug valves for wastewater service shall be as approved by Chesterfield County's Product and Design Review Committee.
- n. If the standard valve provided by a manufacturer does not fully comply with these specifications, but compliance can be attained by providing optional features, then each valve must be permanently marked to indicate the option or options that have been provided. The method of marking valves to indicate that options are included must be approved by the Product and Design Review Committee.

#### **C. SUPPLEMENTAL SPECIFICATIONS**

- 1. **Additional Criteria for Polyvinyl Chloride Piping for Water and Sanitary Sewer Systems: Effective September 1, 1991, all PVC piping must meet the following criteria:**
  - a. Cell Classification for Water Pipe shall be 12454-B.
  - b. Cell Classification for Sewer Pipe shall be 12454-B or 12364-C.
  - c. Water Pipe (C-900) shall meet the specification requirements and have the following certifications from:

- 1) FM (Factory Mutual)
  - 2) UL (Underwriters Laboratory)
  - 3) NSF (National Sanitation Foundation)
- d. All pipe (sizes - 16" and smaller) shall be furnished with standard industry color coding:
- Water - Blue  
Gravity Sewer - Green  
Force Main Sewer - Brown
- e. Manufacturer's Certification of ASTM and AWWA testing requirements will include the following:
- 1) For Water and Force Main Sewer Pipes (C-900) (4", 6", 8" and 12")
    - a) Each piece has been hydrostatically proof tested to AWWA C-900 Requirements
    - b) Pipe meets all other applicable ASTM & AWWA C-900 Requirements
  - 2) For Gravity Sewer Pipe (SDR 35) (4"-15")
    - a) Pipe meets all ASTM D3034 Requirements
    - b) Pipe meets cell classifications as established by ASTM standards, the County's minimum criteria for plastic pipe, and the certification shall state what the cell classification is.
  - 3) Manufacturer's certification will be signed by an officer of the company and will be furnished to the contractor and/or supplier before pipe is delivered to a project site. Certifications from supplier shall include:
    - a) County Contract Number
    - b) Location - Project Name
    - c) Utilities Contractor Name
    - d) Pipe type class
    - e) Manufacturer's name